

Anisothermal stress relaxation test for characterizing elastomers and polymers

Temperature Scanning Stress Relaxation, TSSR) is the name of a newly developed non-isothermal stress relaxation test for thermal elastomers (TPE). Apart from that, the TSSR meter is suited for conventional isothermal tests.

**Brabender[®]
TSSR Meter**

The method

The non-isothermal relaxation measurement is a new method of characterizing thermo-mechanical behavior of elastomers. A specimen is stretched uniaxially at a constant heating rate. The instrument records the tensile stress during non-isothermal relaxation as a basis for the evaluation.

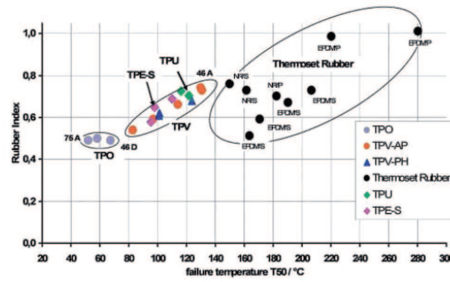
Application

It has proven particularly successful in the fields of development and characterization of TPEs and carbon black filled elastomers. The instrument shows the service temperature range of commercial thermoplastic elastomers. By means of relaxation spectra, different TPE blends can be characterized and distinguished.

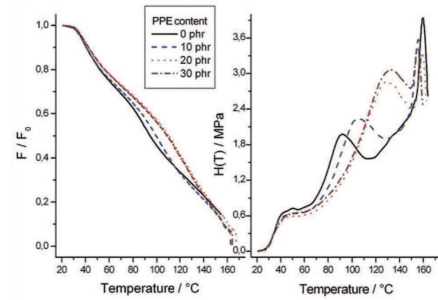
Apart from that, the TSSR Meter can be applied for investigating the effect of different concentrations of cross-linking agent onto the degree of cross-linking. By predicting the compression set value from the temperature limit by means of a linear correlation, the applications of

TPEs can clearly be differentiated from those of carbon black filled elastomers. In case of carbon black filled EPDM compounds, non-isothermal stress relaxation curves supply additional information characterizing the interaction between the carbon black and polymer components.





Differentiation of the applications of TPE and rubber



TSSR Spectrum and stress-temperature-curve for characterizing SEBS/PA₁₂/PPE Blends

Test procedure

The instrument is suited for two different test procedures - the conventional, isothermal relaxation test and the TSSR method. The latter consists of two steps.

In the first step, a type 5A standard bar is fixed in the test chamber and stretched uniaxially at a constant temperature of 23°C over a period of 2 h by 50 % of its original length. During this preconditioning phase, a decay of most of the short-term relaxation processes stimulated by the deformation of the specimen occurs.

In the second, non-isothermal step, the specimen is heated at a constant rate of 2°C/min up to a defined temperature which may be up to 300°C. During both test phases, the instrument records the tensile stress as a basis for the evaluation.

The comfortable measuring and evaluation software under Windows® enables an automatic test procedure, records the data, represents them on-line as a clear color diagram, and evaluates them fully automatically immediately after the test.

Quality Assurance

On the basis of the measuring method of the material development and because of time saving the TSSR Meter is suitable for quality assurance parallel to production.

Characteristics:

$\sigma_{(t)}/\sigma_{0(t)}$	Current tensile stress/tensile stress at the beginning of the test
T 10	Temperature at 10 % decrease of $\sigma_{(t)}/\sigma_{0(t)}$
T 50	Temperature at 50 % decrease of $\sigma_{(t)}/\sigma_{0(t)}$
T 90	Temperature at 90 % decrease of $\sigma_{(t)}/\sigma_{0(t)}$ (end of test)
$H_{(t)}$	Relaxation spectrum
IH	Integral of the relaxation spectrum
$IH_{(T90 - T0)}$	TSSR-Index

Technical Data	
Measuring system:	<ul style="list-style-type: none"> heating/cooling chamber with electric heating and air cooling heating rate 2 x 220 W temperature range 20 - 300°C heating rate 2°C/min (standard), weitere einstellbar running traverse parallel and without play tensile stress: 50% (standard) load cell 0 - 100 N
Test specimen:	Type 5 A standard bar
Connections:	PC via USB compressed air 5 ... 6 bar mains
Mains connection:	1 x 230 V, 50/60 Hz, 16 A, +N +PE
Dimensions (W x D x H)	490 x 610 x 450 mm
Weight:	approx. 20 kg

Subject to change of design and technical modification without notice.

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